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## THE NEED OF INVESTIGATIONS IN HUMAN NUTRITION.

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Read before the Academy, at Topeka, December 31, 1904.

FOR the last seven years it has been the duty of the writer to deliver a course of lectures to junior students on the chemistry of food and nutrition. In respect to dietary standards, these words were used seven years ago: "We are safe in saying that while many good dietaries are in use, we still lack exact knowledge as to food *requirements* of men and women in the several occupations of life. We have indeed a considerable mass of information in regard to dietaries in actual use which are giving good or bad results, as the case may be; but these are all the results of local conditions as modified by the tastes of the people or the notions of those who are feeding them. Most of the standard dietaries are based on observations of food actually consumed by certain people or classes of people, rather than on their requirements for good work." These words have remained true almost up to the present, if, indeed, they are not still so. In the meantime large amounts of work have been given to the study of food actually consumed by various groups of people, but there has been a singular lack of appreciation of the necessity for the study of the actual bodily needs in respect to food. Considerations of the pocketbook have long since determined the execution of experiments of this kind bearing upon the nutrition of domestic animals, but when man comes to consider his own case he seems to prefer to be guided by the results of following appetite, except as its sway has been limited by conditions. Until recently almost no results have been available bearing directly on the question of bodily needs. Even though the physiological fact had been amply demonstrated nearly forty years ago that the metabolism of proteid tissue is not the necessary or even the chief source of muscular energy, we still find, universally prevalent, the view that severe muscular exertion requires large quantities of meat—so firmly fixed have previously conceived notions become.

I had hoped to present the results of experiments looking to a greater knowledge in respect to food requirements at this meeting, but have not been able to complete the analyses. Since undertaking this, knowledge of experiments by Russell H. Chittenden, director of the Sheffield Scientific School, of Yale University, has come to me; also certain other earlier observations by Mr. Horace Fletcher. These observations are of the deepest interest and of prime economic impor-

tance, and in the hands of such a distinguished authority as Professor Chittenden we may expect a continuation of the experiments, with corresponding additions to the knowledge obtained.

As illustrating the great need that had existed for such investigations, it may be briefly stated that the generally accepted standard of Voit for an adult man of average bodily weight (70–75 kilos), doing moderate muscular work, called for 118 grams of protein, or albuminous food, daily, of which 105 grams should be absorbable, 56 grams of fat, and 500 grams of carbohydrates, with a total fuel value of over 3000 large calories. The standards recommended by others were not less, and Atwater, in this country, has recommended a distinctly higher proteid factor and fuel value. Experiments by Siven had indicated that nitrogen equilibrium might be obtained on a much smaller allowance of nitrogenous nutrients, of which a large proportion might be non-proteid. He was able gradually to reduce the total nitrogen of his food to 4.52 grams, or 0.08 of a gram of nitrogen per kilogram, live weight, which corresponds to about 28 grams of proteids instead of 118. Jaffa had also, in a dietary study of a child on a diet of fruit and nuts, observed a gain of nitrogen by the subject with only 0.041 gram of food nitrogen per kilogram, body weight. These results, standing alone, could scarcely be expected to revolutionize a well-settled judgment, but they certainly pointed strongly to the possibility of making great dietary changes.

Within a few years Mr. Horace Fletcher, in experiments on himself, demonstrated to his own satisfaction, and later to the satisfaction of a number of distinguished physiologists, that he was able to maintain himself in perfect health upon a much smaller allowance of food than the standard calls for, including a great reduction of proteids. His experience, and the observations of Professor Chittenden on him, seem to have furnished the initiative for experiments conducted during the last year and a half by Professor Chittenden, and described in a book issued last month, entitled "Physiological Economy in Nutrition, with Special Reference to the Minimal Proteid Requirement of the Healthy Man." It is not my purpose to review this book, but its perusal since handing in my title for this paper furnishes the most ample proof of the necessity for investigation contended for. Professor Chittenden and four other professional men, thirteen men of the United States hospital corps, and eight of the Yale University athletes, engaged in active training, were subjects for these experiments, which extended over periods of time measured by months, or even over a year in some instances. While there were certain individual differences, the exceedingly significant result was demonstrated in every instance that the food taken could be so reduced in quantity

and composition as to possess a fuel value of about one-half to three-fourths that required by the so-called standards, with the reduction of the protein content to in many cases less than one-half or one-third that previously supposed to be necessary. These results, coming from so unquestionable an authority as Professor Chittenden, ought to be revolutionary, and awaken the thinking public to the truth that the natural appetite under present conditions is not a safe guide as to the quantity of food required. It should be emphasized that in all of the cases experimented upon the subjects remained in perfect mental and bodily health and vigor, and in a number of instances experienced marked improvement in these respects. It may also be remarked that the appetite for larger quantities of food rapidly disappeared, and that the attainment of these conditions seems to be materially promoted by thorough mastication and insalivation of the food.